ACCESSION #: 9601300162

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Haddam Neck PAGE: 1 OF 8

DOCKET NUMBER: 05000213

TITLE: Manual Reactor Trip Due to Reactor Coolant Pump Motor Oil

Leak

EVENT DATE: 07/11/94 LER #: 94-018-01 REPORT DATE: 01/24/96

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:

50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: M. Connolly, Systems Engineering TELEPHONE: (860) 267-2556

COMPONENT FAILURE DESCRIPTION:

CAUSE: B SYSTEM: SB COMPONENT: RV MANUFACTURER: A415

X JB LSV A609

B AB CPLG X999

REPORTABLE NPRDS: Y

N

N

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On July 11, 1994, at approximately 0745 hours, with the plant in Mode 1 at 100 percent

power, control room operators received a low oil level alarm for No.3 reactor coolant pump (RCP) motor accompanied by increased bearing temperatures. A load reduction was commenced at 0833 however, at 0907, at approximately 50 percent power, a manual reactor trip was initiated, with subsequent shutdown of the RCP, when bearing temperatures reached 200 degrees F. Immediately following the trip the No.1 feedwater regulating valve failed to close resulting in actuation of the steam generator overfill protection system which closed the feedwater regulating valve and its associated motor operated isolation valve. In addition, one of the main steam safety pilot valves appeared to be simmering. At 0956 a heat detector near #3 RCP alarmed. At 1004 a fire was observed on the pump's insulation. The fire brigade entered the containment and at 1010 the fire was extinguished. The cause of the event was an oil leak due to a cracked PVC coupling on the line leading from the #3 RCP motor upper bearing oil reservoir to its lift oil pump. Corrective action consisted of redesigning the coupling and shimming the supports to eliminate stress. This supplemental report provides the results of the failure cause of the feedwater solenoid valves.

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BACKGROUND INFORMATION

The upper motor (EIIS Code: MO) bearing in each reactor coolant pump (RCP) (EIIS Code: P) is a combination double acting thrust bearing and upper guide bearing. The upper bearing assembly is located in the upper oil reservoir. This reservoir has a capacity of 200 gallons and is provided with an external oil cooler. The reservoirs are provided with local fill connections and gage glass level indicators. The process computer will generate an alarm if any bearing temperature exceeds 176 degrees F. A low oil level will actuate a main control board alarm. The RCP oil lift system minimizes the starting current of the pump by forcing a thin layer of oil between the motor thrust bearing runner and the thrust bearing shoes. The oil lift system consists of an oil lift, or jacking pump, a selector valve, pressure gage, pressure switch, and associated piping. The oil lift system is external to the RCP motor.

The oil lift pump takes a suction on the upper oil reservoir.

The steam generator overfill protection system (EIIS Code: JB) is an Engineered Safety Feature (ESF) (EIIS Code: JE) which will actuate when steam generator narrow range level indication increases to 74 percent as sensed by 2 out of 3 narrow range level instruments. The actuation will occur in either the automatic or manual mode of feedwater regulating valve operation. The actuation signal will generate a main control board alarm for the affected generator and will initiate closure of the feedwater regulating valve (EIIS Code: FCV) and its associated motor operated isolation valve (EIIS Code: ISV).

Main steam safety valve (EIIS Code: RV) MS-SV-14 is one of four Anderson-Greenwood pilot operated safety relief valves (one per main steam line) equipped with a dual pilot assembly for self-actuation of the main valve at a setpoint of 1034 psig. Previous problems (LER 94-006-00 and 94-015-00) with disc and nozzle adhesion in the pilot valves has resulted in increased testing of the valves. One of it's pilot valves, MS-V-1613-1B, had been cycled twenty nine times (not including valve manufacturer testing) prior to the event. This is the most cycles that any of the in-service pilot valves had seen. During normal operation (approximately 675 psig), MS-V-1613-1B showed no signs of seat leakage.

EVENT DESCRIPTION

On July 11, 1994, at approximately 0745 hours, with the plant in Mode 1

at 100 percent power, control room operators received a low oil level alarm for No.3 reactor coolant pump (RCP) motor. This was preceded by several hours of increasing temperatures on all upper bearing surfaces (upper guide bearing, upper and lower thrust bearing). A load reduction was commenced at 0833, however, at 0907, at approximately 50 percent power, a manual reactor trip, with subsequent shutdown of the RCP, was initiated when bearing temperatures reached 200 degrees F.

Immediately following the trip the No.1 steam generator feedwater regulating valve, FW-FCV-1301-1, failed to close resulting in actuation of the steam generator overfill protection (OFP) system which closed the feedwater regulating valve and its associated motor operated isolation valve. Control room operators closed the No.1 steam generator (SG) main steam trip valve to prevent moisture carryover to the main turbine.

Within 8 seconds of receipt of the OFP signal No.1 feedwater flow was decreasing and within 29 seconds feedwater flow was zero.

In addition, a pilot valve for main steam safety valve MS-SV-14 (No.1 SG) showed signs of simmering with main steam pressure at 910 psig. The setpoint for this valve is 1034 psig. It was determined that an excessive amount of steam was being discharged via the vent dome of MS-V-1613-1B, one of two redundant pilot valves that controls the self-actuation of the main valve. Since the dual pilot arrangement allows for isolation of either pilot valve the leaking pilot valve was isolated.

At 0956 a heat detector near No.3 RCP alarmed in the control room. At 1004 a fire was observed on the pump's bowl insulation due to an oil leak from the motor's upper bearing oil reservoir. The fire brigade entered the containment and at 1010 the fire was extinguished.

The plant entered Mode 5 (cold shutdown) on July 19, 1994 at 0030 to perform outage related maintenance.

CAUSE OF THE EVENT

Investigation of the oil leak determined that the source of the leak was a PVC coupling on the line leading from the No.3 RCP motor upper bearing oil reservoir to its lift oil pump. This coupling had cracked allowing oil to

leak out onto the flange of the upper bearing assembly. From there, the oil spread out along the flange and dripped down the side of the motor. Air flow from the stator ventilation openings propelled much of the oil beyond the edge of the oil collection pan at the bottom of the motor. A total of 80 gallons of oil leaked out. Of this, 40 gallons were collected by the oil collection system and 40 gallons were dispersed to the floor, the piping, etc. This allowed a significant amount of oil to drip down between the RCP casing and its insulation. The hot casing ignited the oil (auto ignition temperature of the oil is 475 degrees F) and caused the fire.

The section of piping containing the two inch long PVC coupling and

bounded by a support located immediately downstream of it and the motor itself is merely five inches long. The support was misaligned, which caused the pipe end to be displaced 1/4 inch horizontally. The coupling cracked due to misalignment of the support. This induced a high stress on the coupling which, with vibration induced loads, eventually caused the failure. The corresponding support on the No.2 RCP was found to be misaligned 1/8 inch and its coupling was leaking slightly. It's not known whether the misalignment has always existed or if it arose from bending of the support, during maintenance activities. PVC couplings were installed during initial plant construction when the lift oil pumps were removed from the side of the motors and installed on adjacent platforms to allow installation of the RCP motors in the limited clearance access space through the charging floor.

The cause of the fire was inadequate design of the RCP oil collection system. The design failed to account for air currents which could deflect leaking oil between its leakage source and the drip pan. This condition will be the subject of a future LER.

The cause of the failure of the feedwater regulating valve to close was the failure of either one of two feedwater solenoid valves (SV1-1 and SV3-1) to de-energize immediately upon receipt of a turbine trip signal coincident with a RCS Tavg signal less than 545 degrees F. The valves that were replaced were sent to the vendor for failure analysis. The results of the vendor's investigation indicate the possibility that

excessive contamination (debris) at the core and plug nut faces led to the failure of the solenoid valves.

The cause of the simmering pilot valve MS-SV-1613-1B was excessive seat leakage past the disk and nozzle. Repeated testing of the valves has led to

the increased chance of seat leakage. The leakage was not caused by any potential overfill condition in the steam generator.

SAFETY ASSESSMENT

This event is reportable under 10CFR50.73(a)(2)(iv) since it resulted in automatic actuation of an Engineered Safety Feature (ESF) and manual actuation of the Reactor Protection System (RPS).

The initiation of the Reactor Protection System via a manual reactor trip and the subsequent shutdown of No.3 RCP was to prevent the failure of the reactor coolant pump. The high bearing temperatures could have resulted in the loss of a reactor coolant pump. The loss of a reactor coolant pump would result in a loss of flow accident. The loss of the lube oil could also have resulted in a reactor coolant pump seizure or shaft break. The accident is most limiting at full power conditions. The power level for this event was initially at 100 percent power, however, upon indication of low oil level and high bearing temperatures, a controlled power reduction commenced to the point that the reactor trip was initiated at approximately 50 percent power. This event is bounded

by the current loss of flow and locked rotor/seized shaft safety analyses.

The actuation of the Engineered Safety Feature to prevent steam generator overfill was because of the failure of No.1 steam generator feedwater regulating valve to close following a low power reactor trip. Upon reaching the steam generator overfill protection setpoint of 74 percent narrow range level (per Technical Specification 3.3.3, Table 3.3-3), the No.1 steam generator feedwater regulating valve and the motor operated isolation valve closed. The steam generator overfill protection system performed as designed and prevented overfill of the steam generator. Although challenges to the Reactor Protection System are undesirable, there are no safety consequences or concerns associated with the manual trip actuation. The Reactor Protection System and Engineered Safety Feature responded as expected.

The fire inside the containment building on the reactor coolant pump was of low intensity with small flame fronts which occurred on the piping insulation. Because of the low fire intensity and open areas, there was no significant heat build-up in the general vicinity of the fire areas. As a result, damage could only occur from direct heating of the material in

close proximity to the flames. In general, with the exception of insulation material, there was no damage to plant structures, equipment

or components.

CORRECTIVE ACTION

The following areas were evaluated in connection with the oil fire:

Upper motor bearing integrity - maximum observed temperature on any bearing was 200 degrees F. The motor technical manual limits bearing temperatures to 205 degrees F. Discussions with a Westinghouse motor expert confirmed that, with the observed conditions, no bearing damage is expected. As an additional precaution, an oil analysis was done and motor breakaway torque was measured. No problems were noted.

Motor insulation - The effect of the oil which may have been ingested on the motor insulation has been evaluated and determined to be acceptable. In addition, the motor insulation was hi pot tested and was satisfactory.

Fire damage - The motor and pump and general area were inspected for fire damage. There was no damage other than to thermal insulation. This insulation has been replaced. The fire was located well away from the motor and the seals. Therefore, there was no damage to these components.

During pump startup following cleanup and repair, the motor's vibration, temperatures, and seal water return flow were carefully monitored to verify no other abnormalities. The motor and pump operated normally.

Additional corrective action consisted of redesigning the coupling and

shimming the supports to eliminate stress. The PVC couplings have been replaced with an insulating union.

The oil collection system has been redesigned and accounts for air currents. In general, this involves installation of shrouds around all potential leak sites and the addition of drain lines where appropriate. These modifications are currently in progress and will be completed prior to startup from the current outage.

Feedwater regulating valve, FW-FCV-1301-1 was tested on July 12, 1994 with the existing solenoid valves and operated satisfactorily. The valve was

mechanically tested and radiographed to verify that the plug had not become separated from the valve stem. Solenoid valves SV1-1 and SV3-1 were removed and inspected for fouling and appeared clean. The tubing in various places was also inspected for debris and found clean. Corrective action relative to the feedwater regulating valve involved the replacement of feedwater solenoid valves SV1-1 and SV3-1. The associated circuitry and pneumatic controls were satisfactorily tested. The valves that were replaced were sent to the vendor for failure analysis. The results of the vendor's investigation indicate the possibility that excessive contamination (debris) at the core and plug nut faces led to the failure of the solenoid valves. An engineering evaluation of the control air system will be conducted to determine if any changes have to

be made to prevent this from reoccurring. Currently the air quality of the control air system meets the vendor's recommendations.

Corrective action associated with the main steam safety valve pilot valve consisted of replacing the valve, along with all of the other pilot valves, with a valve containing a different seating material. The reason for the alternate disc material is to correct the adhesion problem between the seating surfaces of the pilot valves. This should decrease the failure rate of the pilot valves during setpoint testing which will reduce the testing frequency and decrease the potential for seat leakage.

ADDITIONAL INFORMATION

Component Manufacturer Model No.

Power Operated Safety Anderson Greenwood 72712Q68/51

Relief Valve

Solenoid Valve ASCO L206-380-7RVU

1 " S80 PVC Coupling

This supplemental report provides the results of the failure cause of the feedwater solenoid valves following completion of the vendor's analyses.

PREVIOUS SIMILAR EVENTS

On July 14, 1993, while in Mode 3, there was a small fire due to an oil leak from the No. 3 RCP motor. The oil came from the same PVC coupling which failed in the present event. In the 1993 event, however, the coupling had cracked as a result of inadequate care during maintenance

and the oil had leaked onto the lagging as a result of incorrect sequencing of the motor disassembly. The fire associated with the 1993 oil leak was because a drip pan was removed prematurely and not because the oil was blown away from the drip pan. Therefore, the effects of blowby oil were not seen in 1993. The root cause was different than in the present case, which is why the corrective actions did not prevent recurrence.

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CONNECTICUT YANKEE ATOMIC POWER COMPANY

HADDAM NECK PLANT

362 INJUN HOLLOW ROAD o EAST HAMPTON, CT 06424-3099

January 24, 1996

Re: 10CFR50.73(a)(2)(iv)

U. S. Nuclear Regulatory Commission

Document Control Desk

Washington, D. C. 20555

Reference: Facility Operating License No. DPR-61

Docket No. 50-213

Reportable Occurrence LER 50-213/94-018-01

This letter forwards the Licensee Event Report 94-018-01, required to be submitted, pursuant to the requirements of the Haddam Neck Plant's

Technical Specifications.

Very truly yours,

F. R. Dacimo

Vice President

FRD/eda

Attachment: LER 50-213/94-018-01

cc: Mr. Thomas T. Martin

Regional Administrator, Region I

475 Allendale Road

King of Prussia, PA 19406

Mr. William J. Raymond

Sr. Resident Inspector

Haddam Neck

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